

Proposal For Trial Program Emergency Medical Technicians Establishing Intravenous Infusions Ventura County, California

September 1996

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I. Introduction

In 1987, Ojai Ambulance received approval by Ventura County Emergency Medical Services (EMS) to staff its ambulances with one paramedic and one Emergency Medical Technician (EMT) who has received advanced training allowing them to assist the paramedic in providing advanced life support (ALS). This advanced training includes assisting the paramedic with such skills as, intravenous cannulation set-up, airway management, trauma skills, cardiac skills, legal issues, and manual defibrillation (Ventura County Policy 505 attached). After reviewing our current system, it is our belief that these advanced EMTs should be allowed to extend their current scope of practice by allowing them to perform intravenous cannulation in the field. By adding this skill to our system we can further improve the efficiency of the team. It has long been demonstrated that IVs can be established in the field setting and have a medically proven track record. Until now, this skill has been traditionally reserved for the paramedic. Under this trial program, the knowledge base of the paramedic will be utilized to direct the EMT to proceed with the mechanical skill of establishing the IV line. At no time will the EMT be attempting cannulation based on his/her assessment. Cannulation by the EMT may only be done at the direction of the paramedic.

II. Study Design

- A. Initial study will be for 18 months, then evaluated for extension.
- B. The study will be a joint venture between Ojai Ambulance, Ventura County Medical Center, Ventura County EMS and The State of California EMS Authority.
- C. EMTs will be selected for this program based on satisfactory performance as an EMT/1 and EMT/D. Each candidate must satisfactorily complete a screening evaluation by their provider, and Base Hospital.

III. Description of Procedure

Peripheral intravenous cannulation with appropriate IV fluid or saline lock.

IV. Medical Condition(s) Requiring Procedure

Any patient who, under existing Ventura County EMS policies and procedures, would require intravenous cannulation by a paramedic.

V. Patient Population To Be Benefited

Those patients who are provided service by Ojai Ambulance, Inc. within the service area known as Ventura County Ambulance Service Area one.
(See exhibit "A" attached)

VI. Medications Utilized

- A. Normal Saline
- B. Dextrose 5% and Water

VII. Relevant Training Guidelines

The attached reference materials have been taken from well established paramedic and EMT training manuals and text books.
(See exhibit "B" attached)

VIII. EMT-1 Training

- A. Instruction for this trial program will be provided by the Base Hospital Pre-hospital Care Coordinator and Ojai Ambulance Paramedic Supervisor. Instructors will be approved by the EMS Medical Director or his designee.
- B. Objectives

1. Describe the purpose for starting an intravenous line in the field.
2. Identify the IV solutions approved for use by field personnel in Ventura County.
3. Identify the IV solution appropriate for volume replacement and as a medication delivery vehicle.
4. Identify three types of IV tubing and give examples of their use.
5. Define "large bore" IV cannula.
6. Identify the checks which should be made prior to using an IV solution.
7. Demonstrate venipuncture and techniques.
8. Identify the indications for using a saline lock.
9. Identify the rationale for using an arm board.

10. Identify possible complications of IV therapy and treatment for each.
11. Identify the need for "sharps" awareness and describe the management of sharps containment.
12. Define: IV push/bolus, IV piggyback, PVADs and the paramedics responsibility.
13. Identify the purpose for labeling all piggyback medication and the information which must be included on the label.
14. Demonstrate, by written and practical testing, an overall understanding of cannulation and IV therapy techniques. (See exhibit "C" attached)

C. Competency testing

Training will be followed by competency testing with a performance standard of 80% - All questions missed will be reviewed with understanding confirmed by verbal feedback.

IX. Medical Control

- A. The program will be evaluated on an ongoing basis at appropriate committees by Ventura County EMS and the State of California EMS Authority.
- B. Each IV start will be evaluated by the Paramedic, Receiving Hospital, Paramedic Provider and Base Hospital.
- C. (See exhibit "D" attached)
Program oversight will be performed by the EMS Medical Director or his designee.
- D. All data will be stored and reviewed utilizing current confidentiality standards.

X. Outcome Evaluation

- A. A success rate of 90% is expected. The EMT-D will be allowed two attempts, after which, the paramedic will assume responsibility for further attempts.
- B. The outcome expected will demonstrate that EMT-Ds and paramedics are equally successful in the establishment of intravenous cannulation.
- C. Retrospective data from paramedic intravenous cannulation attempts within the same service area will be used as a comparison.


FOURTH EDITION

Prehospital Emergency Care & Crisis Intervention

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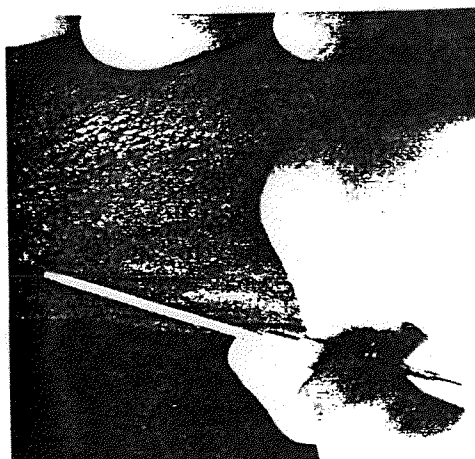
It is recommended that EMTs wear protective gloves whenever there is a possibility of coming in contact with a patient's blood, body fluids, mucous membranes, traumatic wounds, or sores. See Chapter 31.

- Explain what IV therapy is and why it is used in prehospital medicine.
- Describe the equipment and supplies needed to provide IV therapy.
- Learn the steps of and demonstrate proficiency in starting an IV infusion.
- Discuss the importance of proper maintenance and monitoring of the IV patient.
- Demonstrate how to transport the IV patient properly.
- Describe the possible complications of IV therapy.

* OBJECTIVES



Intravenous Fluid Therapy



appendix 2

- To add fluid volume to the circulatory system when there is an imbalance or depletion of normal body fluids, as in hemorrhage, burns, and dehydration.
- To establish and maintain a life support or access line for fluid or medication in a patient whose condition is questionable. It is difficult to get into a vein and start an IV after hypovolemia or circulatory collapse.
- To provide access for the administration of medications in a myocardial infarction or cardiac arrest, diabetic emergencies, drug overdose, etc.

IVs are started in the field for four major reasons:

□ WHY INFUSION?

Body fluids bathe each cell and are involved in all bodily chemical reactions. Without the proper amounts of body fluids, cells dehydrate and die. Body fluid consists of water (60 percent of the volume of adult bodies and 75 percent of infant bodies) and electrolytes (sodium and potassium). These fluids are found both inside and outside the cell. Extracellular fluid includes the interstitial fluid between the cells and the capillary walls, and blood plasma within the vascular system.

□ BODY FLUID COMPOSITION

Intravenous therapy, commonly called IV, refers to the administration of fluids, drugs, or blood directly into the circulatory system by way of a vein. When blood is administered, the technique is called transfusion. When sterile fluids other than blood or blood products are administered through a line injected into the venous system, the technique is called infusion.

An IV is a lifeline through which fluids and medications are administered to a patient. The fluid container can empty its reserve in minutes. A dropcock, or drip chamber, placed below the container, regulates the flow of the fluid.

□ WHAT IS INTRAVENOUS INFUSION?

In many states, EMTs are being taught the basics of venipuncture and intravenous (IV) therapy for use in the field to expand the level of life support care given. IV therapy should only be administered by IV-certified EMTs; follow local protocol.

The equipment used by EMTs is usually disposable. Some medical facilities provide reusable, sterile infusion sets. In any case, the equipment will basically be the same, consisting of:

- The fluid to be infused.
- The IV set (Figure A2-2 shows micro drip and macro drip sets), consisting of the connector (to the fluid bottle or bag), drip chamber, screw clamp or flow adjustment valve, Y injection site (for medications), needle adapter, and needle and catheter.

□ SETTING UP AN IV

- N.S., or normal saline, which is 0.9 percent sodium chloride in sterile water.
- Lactated Ringer's, an isotonic, buffered solution of electrolytes (sodium, chloride, potassium, calcium, and lactate) that closely approximates normal blood electrolyte contents (Figure A2-1).
- D₅W, which is 5 percent dextrose and sterile water. It is used in cases where an IV is established as a lifeline or a medication route.

A significant decrease in fluid volume must be countered rapidly, or shock may result. The body may also go into chemical imbalance and negatively affect the functioning of vital organs. The types of solutions used for field IVs include crystalloids and colloids. Colloids and crystalloids are volume expanders given to patients whose condition results in compromised circulation of blood to body tissues. They do not carry oxygen or replace blood but can provide electrolytes, protein, and volume expansion to help maintain blood pressure.

Crystalloid solutions quickly expand plasma, are rich in electrolytes, and take effect more quickly than colloids. However, they last only a short time. Colloids take effect more slowly than crystalloids but last longer in the plasma. They are particularly helpful for patients with hypovolemic or cardiogenic shock. Examples of colloids are dextran and hetastarch (serum albumin is a natural colloid). Examples of crystalloids are: (Table A2-1)

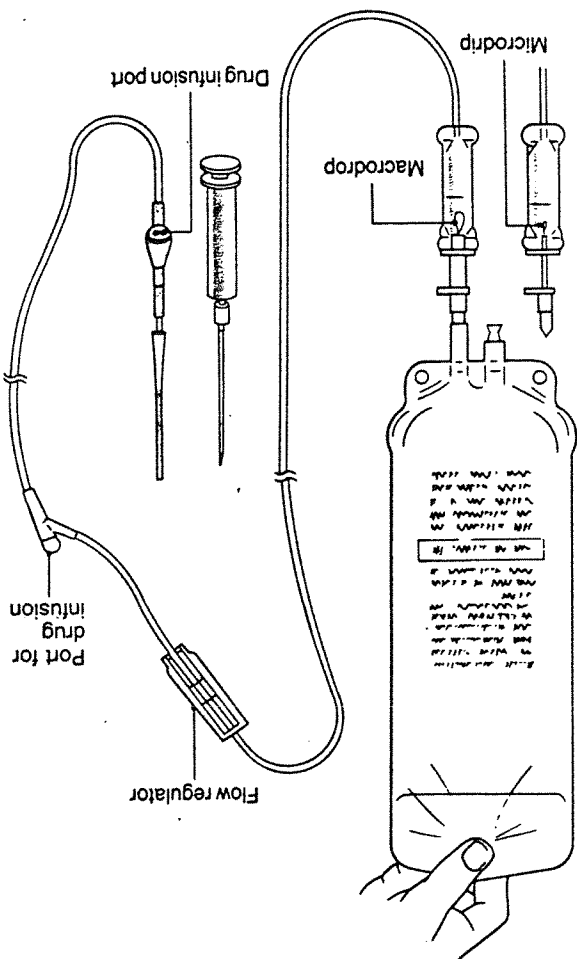
□ ADDING FLUID VOLUME

- To maintain electrolyte, fluid, and nutrient balances for those unable to eat or with problems of severe nausea, vomiting, and/or diarrhea.
- Be sure to get specific instructions from the physician and document the orders.

Two types of IV sets are commonly used — macro drip and micro drip. The macro drip sets are used for rapid fluid replacement by large drops of fluid through a large-bore tube. This macro drip, or standard, infusion set is typically used for adults to give large amounts of

Choosing the IV Set, Needles, and Catheters

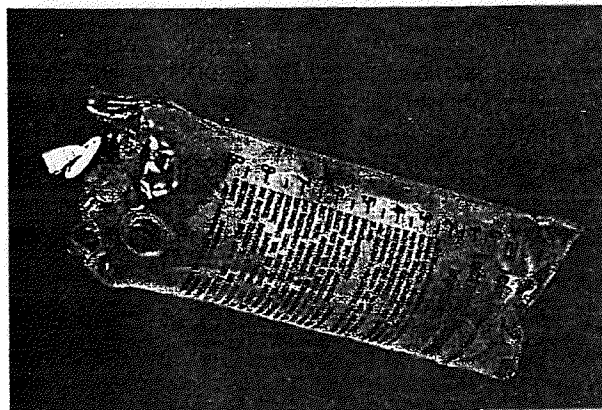
FIGURE A2-2 Comparison of macrodrip and microdrip IV administration sets.



It is important that all equipment be sterile. If the equipment is contaminated, germs may be introduced into the body and cause infection. If you do not know that the equipment is sterile, consider it contaminated. A sterile object remains sterile only if touched by another sterile object. It is very important that you be honest and make it known if a piece of equipment becomes contaminated — it needs to be replaced.

- Auxiliary equipment (Figure A2-3), such as an arm board, antiseptic solution, tape to secure the IV tubing to the patient's arm and the arm to the board, a tourniquet to aid in selection of the insertion site, gauze pads or a sterile dressing such as Opsite to cover the insertion site, materials to log or write down any necessary records concerning the procedure, and IV extension tubing to give added length to the IV while transporting.
- Several gloves and possibly a face mask and eye protector to be worn by the EMT.

FIGURE A2-1 Lactated Ringer's, a solution commonly used in IV administration.



Note: D5 or D10 as a prefix indicates the solution is made containing dextrose. For example, Lactated Ringer's in 5% dextrose would be abbreviated D5LR.

SOLUTION	ABBREVIATION	COMPONENT ELECTROLYTES
Lactated Ringer's	LR	NaCl, potassium chloride (KCL), calcium chloride (CaCl), sodium lactate
Quarter-normal saline	1/4 NS	0.2 NaCl
Half-normal saline	1/2 NS	0.45% NaCl
Normal saline	NS	0.9% sodium chloride (NaCl)
5% dextrose	D5W	5% dextrose
10% dextrose	D10W	10% dextrose

Assembling the Equipment

Following these procedures, and using only the type of fluid ordered by the physician, perform the following steps.

1. Check the container to make sure that the expiration date has not passed.

2. Plastic bag infusion sets are preferable to glass in the field. If a glass bottle is used, inspect it for cracks.

3. Remove the sterile seal from the end of the tubing closest to the drip chamber and insert the tubing into the container. The tubing also has a sterile seal on it. You may have to loosen this seal to allow the liquid to flow, but you should not remove it.

4. With either container, check for seal leakage, cloudiness, discoloration, or contamination. Do not use any fluid that is colored or cloudy or that contains floating particles. Save the bag and report the problem to your equipment manager so that he or she can inspect other supplies in the same lot.

5. As you open the packages to assemble the infusion set, keep all necessary items sterile by not touching areas that will come in contact with the fluid. Do not use your teeth to rip open the coverings on the bags and tubes. It is a good idea to have extra alcohol wipes and a spare catheter near. Tear the tape to the right size for securing the catheter and tubing.

6. Connect the infusion set to the fluid container by holding the drip chamber, removing any protective coverings (do not touch the spike tip), then inserting the piercing pin into the fluid container with a twisting motion (Figure A2-5).

7. Attach the extension tubing, then squeeze and release the drip chamber or reservoir on the infusion set until it is about half full.

8. Remove the protective cover from the needle adapter. Inspect the needle and cannula for irregularities. If the needle is not sharp and without burrs and if the cannula is not smooth, discard them.

9. Open wide the flow adjustment valve, and flush any air from the tubing. No air should be left in the line, or it may enter the patient's vein, causing an air embolus or blockage. Some EMTs save time and eliminate this step by preflushing IV fluids. If you use this procedure, label the bag with the time, date, and your initials. Fluids and tubing should be discarded after a maximum of twelve hours.

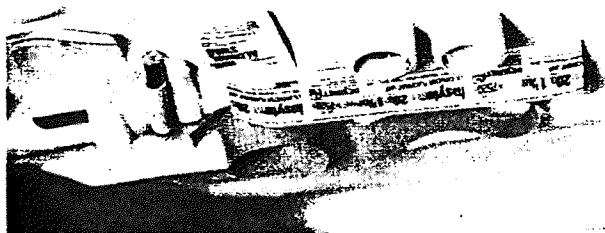


FIGURE A2-3 Auxiliary equipment.

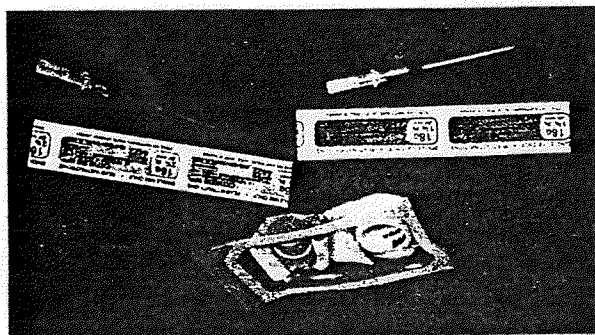
fluid. The micro drip set has a small-bore tube, allowing a smaller drop, and is used for children, for maintaining a lifeline, or for other situations where control of the IV rate is critical.

The primary type of needle used to enter the vein in the field is an over-the-needle catheter (a plastic catheter inserted over a hollow needle). Other types of needles are a butterfly or winged hollow needle, or a plastic catheter inserted through a hollow needle. (Figure A2-4). In general, a short, large-bore needle is best for IV therapy. One- or two-inch-length catheters are the most commonly used in the field, with needle sizes of 14, 16, and 18 gauge (the lower the gauge, the larger the bore of the needle) for fluid replacement. An 18 gauge is generally the smallest used in any adult and most children, but a 20 gauge may be used for small children or older adults with fragile veins that will not accommodate a lot of fluid.

The other variable that should be considered when selecting an intravenous cannula is its length. The longer the cannula, the less the flow rate will be. The flow rate through a 14 gauge, 5 cm catheter (approximately 125 mL/minute), is twice the flow rate through a longer, 16 gauge, 20 cm catheter. For cannulation of a peripheral vein, a needle and catheter length of 5 cm is adequate while the cannulation of a central line requires a needle length of 6–7 cm and catheter length of at least 15–20 cm.

Other needed equipment includes alcohol swabs, povidone-iodine solution, tape, and sterile dressings.

FIGURE A2-4 The IV needles most commonly used to administer IV fluids in the prehospital setting.



time the IV was started, and the initials of the EMT who started the IV.

□ THE IV PROCEDURE

Follow these steps in administering an IV:

1. Explain the procedure to your patient and why you are doing it. Be professional and calm, allowing the patient to have confidence in you. Ask the patient about any possible allergies to tape, fluids, iodine, etc.
2. Prepare yourself properly to prevent any possibility of the patient's blood coming into contact with you. Wear surgical gloves and possibly a face mask and eye protection (see Chapter 31).
3. Select a proper site.

- Unless the patient's arms have been severely traumatized, use arms rather than legs for placing IVs. The arms have a lower risk of phlebitis than legs.
- Have the patient hang his or her arm for a couple of minutes. Apply the tourniquet three or four inches (adult) above the antecubital fossa (Figure A2-6). The tourniquet should occlude the venous pressure but not the arterial. If a blood pressure cuff is used as a tourniquet (sometimes good for better control), inflate it to 15 to 20 mmHg below the systolic blood pressure. The distal pulse should still be present.

FIGURE A2-6 Place a constricting band above the site for the venipuncture.



FIGURE A2-5 Hold the drip chamber and insert the piercing pin into the fluid container with a twisting motion. (Apply protective gloves before initiation of an intravenous line.)



10. Adjust the flow valve until the flow stops, then replace the protective cover over the needle adapter and protect it from contamination.
11. Select the needle or IV catheter best suited to the patient (18 gauge is normally used). The needle should be large enough that it will enter the vein easily but without tearing it.
12. Select an appropriate infusion set. Is it for fluid replacement? Micro or macro?

- Be familiar with the type of IV fluid — always use the same type of fluid if hanging a new container.
- Be aware of any additives in hanging a new bottle or in the original container of the IV fluid.
- Keep the container three feet above the insertion site at all times.
- Time-label the IV solution container. Tape the side of the container with date, time hung, and rate of solution per hour.

These points are discussed with ideal conditions in mind, but often in the field, they are not, and time is at a premium. Documentation is often left until you reach the emergency department, where the flow rate and possibly the fluid may be changed. It is very helpful to hospital personnel if, on a piece of tape over the insertion site, you write the gauge of the needle, the date, the

- If it is not, loosen the tourniquet until the arterial pulse returns.
- Look on the forearm or back of the hand for a fairly straight vein that lies on a flat surface. The vein should feel springy when you palpate it. Usually the forearm is the first choice. Creation of a pulse wave helps in locating a good vein (Figure A2-7). (The American Heart Association's Advanced Cardiac Life Support Text recommends using the antecubital vein in cases of cardiac arrest. This vein can also be used in cases of severe circulatory collapse.)
- Choose the top side of the arm above the wrist or the back of the hand.
- It is a good idea to start the IV as low as possible on the limb. If a problem arises, the next IV will need to be inserted above the heart in relation to the first site. The basilic, cephalic, or median veins are common sites for IVs.
- Avoid sites where veins are near injured areas, or where arterial pulsations are found close to the vein being considered.
- Stay away from joints.
- Because the needle must enter the vein lengthwise, know the direction of the vein. Track the direction for one to one and one-half inches (or at least the length of the catheter used).
- 4. Prepare the IV site. You should scrub and disinfect the site in two separate steps. Use an alcohol scrub to remove dirt, dead skin, blood, mucous, and other contaminants from the surface.
- Cleanse the selected site with an iodine or alcohol swab. Sponge the antiseptic directly over the selected vein, then rub in a circle until an area one to three inches is covered. Rub in a circular motion, starting at the puncture site and going out. Never go back over the area just cleaned with the same wipe.
- If a povidone-iodine solution is used, follow with an alcohol wipe in a circular motion, starting at the venipuncture site. This reduces the risk of a reaction. If you have scrubbed and disinfected with alcohol in both steps, be sure to prep for at least sixty seconds using at least two or three wipes. Do not rush this step. It takes time for alcohol to act on the skin microorganisms.
- 5. If the patient is responsive, briefly explain the purpose of the IV and the procedure for initiating it.
- 6. Have the patient clench and unclench his or her fist several times. This will improve venous distention. Now select a distended vein that appears straight and that lies on a flat surface. Do not palpate the vein with your bare fingers or soiled

- 7. Stabilize the vein by gently applying pressure on it an inch below the point where the needle will enter. (If you feel a pulse, *do not* use this site. It is an artery! Select another site.)
- 8. Press the vein downward, toward the wrist, so that the vein does not roll.
- 9. With the bevel (the slanted end of the needle) up, align the needle so that it will enter the skin at a twenty- to forty-degree angle and in the direction of the venous flow. Remember — the needle must enter the vein lengthwise (Figure A2-8). Some services use a bevel-down technique in cases of difficult or rolling veins.
- 10. Pierce the skin and insert the needle into the vein (Figure A2-9). Smooth movement of one-fourth to one-half inch hurts the patient much less than small, apparently insignificant movement as the IV is started. You should feel some resistance, then a "pop" when the vein is punctured. A confirmation that the needle is in the vein is when the blood appears in the flash chamber at the end of the needle (Figure A2-10).
- 11. A difficult IV start may be enhanced by using a syringe. A syringe may mean the difference between success or failure. To perform this procedure:
 - Insert the needle about 5 mm, but no more.
 - Slide the catheter into the vein by pushing the hub until the catheter is fully in the vein (Figure A2-11). *Do not* advance the needle and catheter

FIGURE A2-7 Hold the patient's hand and press downward with your thumb. This will create a pulse wave that will help you select a good vein.



17. Tape the catheter securely in place (Figure A2-13). Taping is critical in maintaining the IV. However, do not apply tape completely around the extremity. This could cause a tourniquet effect, decreasing circulation to the distal portion of the extremity.
18. Loop the IV tubing and tape it to the arm with generous, secure taping (Figure A2-14). Attachments such as a T-tube and IV loop can reduce the problem of pinching off a large loop of IV. *Do not* tape the point of connection between the catheter and the infusion set, however. Apply an arm board if it is necessary to minimize arm motion. (See also Figure A2-15).
19. Write with ink on the tape the type of cannula used, the needle gauge, the catheter length, the

FIGURE A2-13 Tape the catheter securely in place and tape the looped IV tubing to the arm.



FIGURE A2-12 After holding the catheter hub in place and withdrawing the needle, remove the tourniquet.

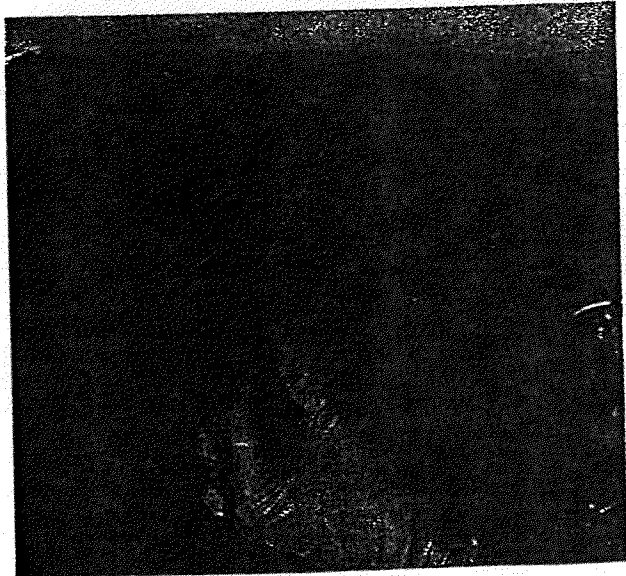


FIGURE A2-14 Securing an IV.

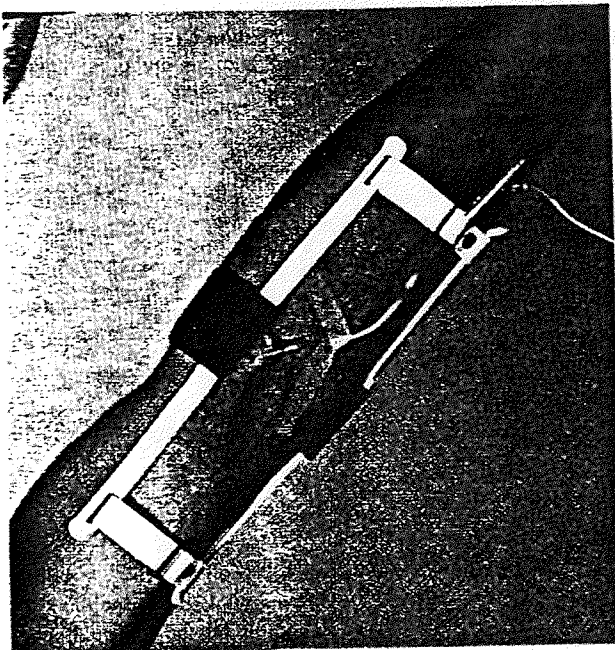
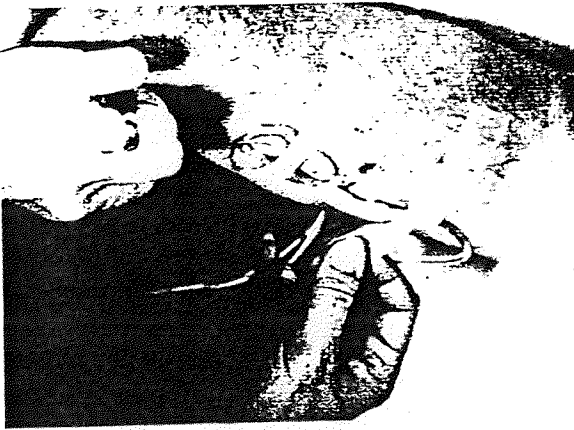


FIGURE A2-15 A butterfly catheter may also be used in the field. Loop the IV tubing and securely tape it to the arm.



- time and date, and the initials or signature of the EMT who performed the procedure (Figure A2-16).
20. Adjust the infusion to the flow rate (ml/hour) or—dered by the physician. It is essential that the proper flow rate be monitored and maintained (Figure A2-17). Too much IV fluid can be dangerous to the patient, especially to children. To adjust the infusion to the ordered flow rate, you must know the volume to be infused and the amount of time that the volume is to be infused. The following formula will allow you to calculate the proper flow rate:

$$\text{flow rate in drops per minute} = \frac{\text{volume to be infused} \times \text{drops per ml that the set delivers}}{\text{infusion time in minutes}}$$

13. Remove the protective cap from the end of the infusion set, then attach the needle adapter by twisting it securely into the hub. The area around the infusion site should be clean and dry.
12. Maintain firm pressure on the vein above the catheter and make a quick, visual check to see that all is ready.
11. While holding the catheter hub in place, carefully withdraw the needle.
10. *Do not push the catheter back into the vein. This action may cause the catheter to be sheared off by the needle.*
9. *Do not push the catheter back over together, and do not push the catheter back into the catheter. This action may cause the catheter to be sheared off by the needle.*

FIGURE A2-9 Pierce the skin and insert the needle into the vein.



FIGURE A2-8 Hold the needle at a 20- to 40-degree angle in the direction of the venous flow, bevel up!

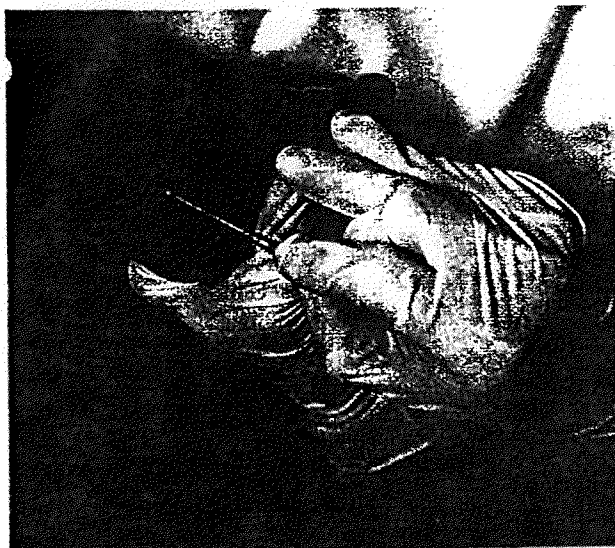
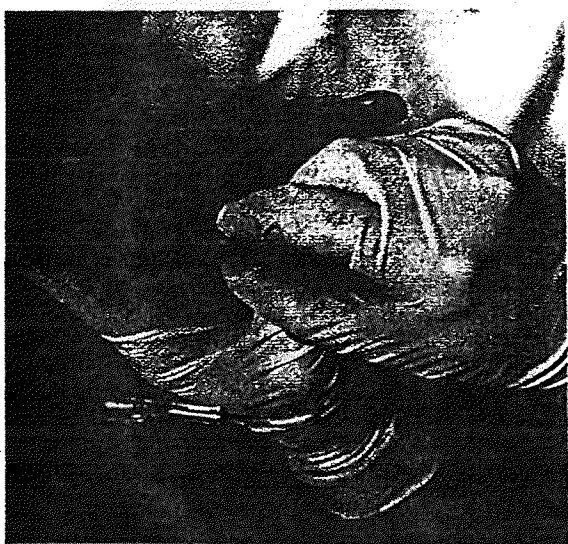


FIGURE A2-10 Blood appearing in the flash chamber is confirmation that the needle is in the vein.



8. Remove the tourniquet (Figure A2-12).
7. Blood loss through the catheter can be stopped by compressing the vein near the tip of the catheter with a finger or thumb.
6. Open the flow adjustment valve.
5. The fluid should drip steadily into the drip chamber. If it does not, gently pull the catheter out 2 to 3 mm only. The drip should now flow steadily.
4. Apply povidone-iodine solution and cover the infusion site with a small gauze pad (follow local protocol; some use a clear cover for the IV site, such as Opsite). Be aware of radine allergy (swelling and redness).

FIGURE A2-11 Now slide the catheter (and IV tubing) into the vein.



When the stabilized patient is ready to be moved, elevate the fluid container well above the level of the heart via an IV pole or a well-instructed helper. If the fluid is in a bag rather than a bottle, the bag may be placed under the patient's head or shoulder until it can be hung up. The helper carrying the IV needs to stay at the infusion site as the patient is moved. Watch the IV continuously for complications.

Moving down a staircase or over rough terrain can dislodge an IV, so take steps to guard against accidental dislodging. You can safely stop the IV drip for two to three minutes if necessary and strap the fluid container to the patient to move over rough terrain. Do not exceed this limit, however, as the blood will clot and the IV will need to be restarted.

□ TRANSPORTING THE IV PATIENT

1. A red line coming from the site (a hard red vein, indicating phlebitis) or any redness.
 2. Any discharge at the site.
 3. Any swelling around or above the site. This probably means that the IV catheter is out of the vein and that the fluid is escaping into the tissues. You must discontinue the IV immediately.
- Signs of infection include:
- An infected IV site could cause complications.

1. Check that the tape is holding the catheter secure and is not wet.
2. Ask the patient if there is any pain or burning at the IV site.
3. Check the skin to see if it is cool to touch around the site. If it is warm to the touch, there is probably or infiltration.
4. Make sure that the connection between the catheter and tubing is secure.

□ SIGNS TO LOOK FOR AT THE SITE

4. Check the tubing.
5. Check the catheter by pinching off the tubing a few inches ahead, then pinch and release the tubing between the kink and the catheter. You should see a reddish tinge of blood enter the line. If the catheter is plugged, radio the hospital and follow the physician's instructions. He will probably have you begin an IV at another location.
6. Check to see that the flow adjustment valve has not been accidentally closed.

1. Check the tourniquet to make sure that you have released it.
2. Check the level of fluid in the bottle or container, and increase its height. The IV bottle should always be at least three feet above the insertion site.
3. Reposition the arm.

If the IV stops dripping:

The IV is fragile and must be handled with care. Carefully monitor the flow rate and make sure that the flow adjustment valve is working properly. Occasionally reposition the arm and inspect the tubing for kinks. Check fluid levels to make sure that you do not run out. Palpate the area around the IV to confirm that the IV is infiltrating the vein and not the tissues surrounding the vein.

□ MAINTAINING THE IV

The greater the pressure, the greater the flow. However, pressures greater than 250 mmHG to 300 mmHG may cause rupturing.

$$\frac{1000 \text{ ml} \times 10}{42 \text{ drops per minute}} = \frac{240 \text{ minutes}}{42 \text{ drops per minute}}$$

If the physician orders an infusion of 1 liter (1,000 ml) of normal saline in four hours, and the infusion set is capable of providing 10 drops per minute is calculated thus:

FIGURE A2-17 Turn on the IV and check the flow.

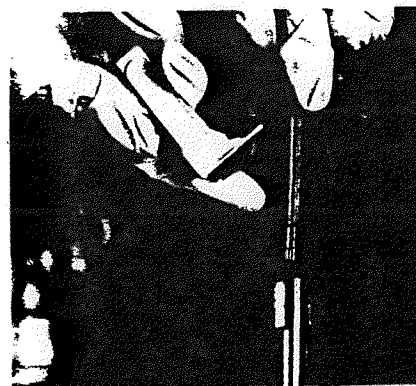
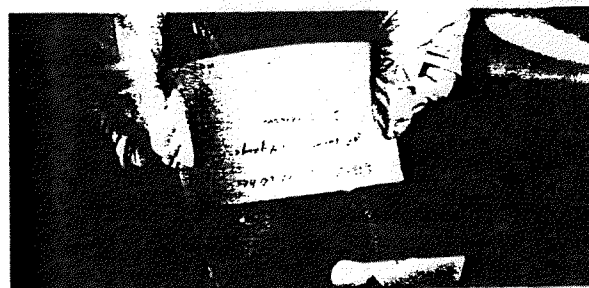


FIGURE A2-16 Label the bag.



¹ These sections were prepared with the help of Dave Dodds.

Three major complications that can result from infusion are infection, pyrogenic reactions, and phlebitis. These risks can be minimized with proper attention to technique.

□ IV COMPLICATIONS

Important tip: At the time you obtain the medication information, write the facts on index cards and file them in an accessible place in your ambulance. You can then refer to them in the future (they are also handy for studying purposes). The dispatcher should have a current Physician's Drug Reference.

- The generic and chemical name.
- The classification.
- Indications for use.
- Adverse reactions.
- Normal dosage.
- Signs and symptoms of a reaction.
- What to do if a reaction occurs.

It is extremely important to know the following information about medications:

- Do not forget to check at the IV site and make a quick assessment of the body area for any rash that could be the beginning of an allergic reaction to the medication, along with a change in vital signs.
- The kind of solution and number of milliliters the container holds. The label on the solution is usually bright-colored. The label should contain the name of the patient, the name of the medication, the dosage, the date, and the time administration was started.
- The reason why the patient is receiving this medication (certain drugs can be administered for different reasons).
- List of medications previously administered.
- Allergies.
- The diagnosis.
- Physician's name.
- Patient's name.

Before transporting a patient with an IV infusing, make sure that you have the following information:

□ IV MEDICATION

- It provides a complete checklist for IV and other body tubings.
- You are able to use this checklist as a quick patient assessment.
- It validates any abnormalities that may be present.
- It provides continuity for health-care workers.
- The form filled out accurately is important for insurance claims and for verification of the health-care facility.
- It provides patient protection for optimum care.

Figure A2-18 is the recommended documentation form that you need to fill out along with the nurse. This is another precaution. If, during the examination, you find something wrong, draw it to the attention of the nurse and tactfully ask the nurse to correct the problem. The documentation form is necessary and helpful for the following reasons:

Before transporting an IV patient to another facility, obtain a report about the patient from the nurse in charge. Also do a quick evaluation with the nurse present. It is of prime importance that you have as much information as possible regarding that patient, since any problem that may occur from then on is your responsibility. Be aware of and plan for the problems that can occur if the patient is anxious or confused. A confused patient can try to pull out the IV.

□ PATIENT ASSESSMENT PRIOR TO TRANSPORTATION¹

It is necessary to transport a patient with an IV, make sure that all information about the patient and the fluid has been given to the ambulance team and that an IV-trained EMT is on the ambulance. Know what the physician wants you to do if the fluid runs out before the ambulance reaches its destination.

When the ambulance is reached, the IV carrier enters the compartment before the patient. Place the container on the hanger when possible. A quick check of the IV equipment and the patient should take place before the ambulance proceeds. Continually monitor vital signs during transport. When you arrive at the hospital, the IV helper takes the IV off of the holder. Then the patient can be unloaded, with the helper again at the infusion site.

CHECK OFF PRIOR TO TRANSFER WITH NURSE

Patient's Name _____
 Diagnosis _____
 Reason for Transfer _____

IV MAINTENANCE

Solution _____

Kind _____

Labeled with patient's name _____

Labeled if there are additives _____

Drip rate _____

Is solution time labeled _____

How many ml in bag or bottle _____

Need another bag or bottle _____

Label check with bag that is hanging _____

Is IV patent _____

Clamp on tubing correct _____

IV secure to extremity — armboard _____

IV site _____

Redness _____

Swelling _____

Any wetness _____

Patient complaining of IV burning _____

Signature, EMT and Nurse _____

BODY TUBINGS

Does patient have any of the following tubings

Nasogastric _____

Feeding _____

Tracheostomy _____

Gastrostomy _____

Colostomy _____

Urostomy _____

Foley catheter _____

Rectal tube _____

Signature, EMT and Nurse _____

Are tubes secured correctly? _____

Are tubes patent — no kinks? _____

Are colostomy or other stoma bags

intact and empty? _____

Is foley bag empty? _____

FIGURE A2-18

Phlebitis is the localized inflammation of a vein that leads to the formation of a small clot. As the clot grows, inflammation increases, partially or completely blocking the vessel, or detaching from the vessel and lodging elsewhere in the body. Phlebitis greatly increases the patient's risk of sepsis, as bacteria tends to accumulate at the site. Trauma, diabetes mellitus, age, or immunodeficiency can foster such an accumulation, rapidly leading to septic shock and death.

Phlebitis

If these reactions occur, stop the infusion immediately! Begin a new IV with new equipment in the other arm. Treat for shock, and advise the physician by radio. A misplaced needle (misses the vein or tears through it) will cause fluid to leak into the surrounding tissues. Visible and palpable swelling will occur, and the patient will experience a painful, burning sensation. Stop the IV and begin a new one in the other arm. Inform the physician of your actions.

- Shock, with a possibility of vascular collapse.
- Malaise.
- Nausea, vomiting.
- Backache, headache.
- Severe chills.
- Abrupt fever.

following:

Pyrogens (foreign proteins) enter the body by way of contaminated fluid. If fluid shows leakage or cloudiness, do not use it. Pyrogenic reactions usually begin one-half hour after the IV is begun and present with the

- Keep all possible equipment sterile.
- Use sterile or unsterile but clean gloves. Use of a surgical mask is also suggested.
- Examine equipment, solutions, and tubing for flaws.
- Always use aseptic or sterile technique.
- Remove rings and watches from the patient. The watch may act as a tourniquet.
- Always maintain sterility when opening packages or any IV equipment.
- Examine all packages and equipment for flaws.
- Inform the patient of the reasons for your precautions.

Infection usually results from poor aseptic techniques. Being careful to prevent contamination is the key. A patient who has an IV in his or her vein has an open entry into his or her circulatory system. To prevent contamination when working with an IV:

□ OTHER IV THERAPY COMPLICATIONS

Patients in emergency departments have almost twice the risk of complications from IV therapy as patients whose IVs were initiated in other parts of the hospital. And patients whose IVs were begun in the field have over four and one-half times as much phlebitis than patients whose IVs were begun in the emergency room. Twenty-two percent also developed fevers — five and one-half times the percentage of those whose IVs were started in the emergency room. Even more alarming, symptoms of phlebitis can continue to develop even after the catheter has been removed and may not appear for days.²

The causes for these higher rates of complication seem to be incomplete decontamination, catheters that are too large, and rough insertions. In a field setting involving trauma, there must necessarily be trade-offs between ideal circumstances and speed. With trauma patients, using smaller catheters is not an option because of the need for rapid fluid infusion. But experts recommend that there be no attempt to speed up decontamination and that all IVs started in the field be removed and replaced in the hospital.

Air Embolus

An air embolus may result from a malfunction of the infusion line, or from allowing the fluid to run out completely, thus drawing air into the line via the air vent. The victim of an air embolus will rapidly develop shock and cyanosis and may possibly become unconscious. If an air embolus is suspected, use a hemostat to clamp the tubing close to the body. Place your patient on his left side, with legs elevated and head down. Inform the base physician. Lower the head of the stretcher or bed. Give oxygen and transport to the nearest emergency room.

Plastic Embolus

A plastic embolus may be caused by withdrawing the needle from the catheter, then reinserting the needle, causing the sharp, beveled tip of the needle to cut off a small piece of the plastic catheter. Radio-opaque catheters are better than radiolucent for finding catheters that have been sheared off. However, the opaque catheters are more difficult to "slide" into the skin.

Other complications may arise from an IV that is not started or tended to properly. Always check to see if the IV is positioned properly, and if the tourniquet is still on.

² David Lawrence, "Prehospital IV Therapy," *JEMS*, January 1990, pp. 51-52.

Circulatory Overload

Circulatory overload, or too much fluid in the circulatory system, can be caused by a "runaway" IV, or by an IV that provides too much fluid. This may force fluid into the lungs, causing pulmonary edema. Signs of circulatory overload are:

- Venous distention.
- Raise in blood pressure.
- Shortness of breath.
- Coughing.
- Increased respiratory rate.
- Dyspnea.
- Frothy sputum resulting from fluid buildup in the lungs.
- Cyanosis.

If these signs are present:

1. Use a microdrip.
2. Elevate the patient's head.
3. Turn the IV to TKO (to keep open). Leave the IV inserted, as the patient will probably need it for IV medications such as Lasix, which is used to rid the body of fluid.
4. Notify the physician immediately. Monitor the patient closely, be prepared to give emergency care, and document the entire procedure.

Allergic Reactions

If your patient has an IV medication infusing or has an additive to his or her IV, be alert to a possible allergic reaction. Watch for the following signs:

- Itching.
 - Rash.
 - Shortness of breath.
 - Anaphylactic shock can develop.
- If there is a medication infusing:

1. Clamp off.
2. Do not *discontinue the IV*, but slow down to TKO.
3. Monitor the patient closely.
4. Be prepared to give emergency care.
5. Transport to the nearest emergency room.
6. Document the entire procedure.
7. A medical doctor may order fluid or a medication change.

Infiltration

Infiltration means the escape of IV fluids into the surrounding tissues, which can cause tissue damage and necrosis. If the IV solution contains a drug toxic to subcutaneous tissue, it can be disastrous; it could require reconstructive surgery.

It is of utmost importance to monitor the IV site for edema, pain, and temperature. The area above the IV site may feel cooler or warmer. Look for leakage of fluid around the site. Another sign could be a sluggish flow rate.

Stabilize the extremity with the IV. It is important for the extremity with the IV to be still. Use of the catheter over the needle rather than the butterfly will reduce the occurrence of damage with movement. If infiltration occurs, stop the IV and begin a new one in the other arm. Inform your base physician of your actions.

Blood Back-up In Tubing

During your observation, you may notice blood beginning to back up in the tubing and/or possibly a clot at the end of the catheter. Look for the obvious first, returning to back up in the tubing and possibly a clot at the end of the catheter. Look for the obvious first, remembering that a blood back-up or clotting usually occurs due to a slow or absent flow rate or improper placement of the IV solution container. Also, if you forget to flush the IV, the blood will run up the tubing. If this happens, the tube must be unhooked from the IV, flushed, then reconnected.

Start at the top. Check to see that the IV container is not empty. Is it elevated enough? How is the flow rate? If the purpose of the IV is TKO (to keep open), that can be a factor. Do not forget that a TKO drip rate needs to be wide open for one to two seconds, every one-half to one hour. Is the drip chamber half full? Check the flow clamp for position. Observe if the tubing is kinked, or if the tubing is dangling and preventing the solution from reaching the patient.

Next, check the IV site. Are any signs present that might explain the problem, such as the catheter being lodged against the vein wall? Gently move the catheter slightly. You may have to attempt to aspirate the clot out of the catheter with a sterile syringe. Never irrigate IV if you cannot aspirate a clot, for this could cause an embolus. Remove the IV and start a new one.

Cold

IV solutions can freeze in the tubing or container very rapidly. You may want to start an IV in the ambulance or in a heated building, if possible. Protect the tubing and container from cold during transport. If a patient in hypovolemic shock is receiving large volume of fluid, warm them to body temperature or you may cause the patient's core temperature to drop, triggering hypothermia.

☐ BLOOD TRANSFUSIONS

As an EMT, you do not normally transport blood transfusion patients. If you feel uncomfortable or if the medication maintenance does not fall within the realm of your duty, ask the facility to send a nurse or physician to perform those duties/skills.

☐ IV DISCONTINUATION

It is important to evaluate the circumstances before you decide to discontinue the IV. Use the following guidelines:

- Discontinue an IV immediately if the fluid is going into the tissues, not the vein.
- With a clotted-off IV, it is possible (if your arrival to the other facility is within five minutes) to wait for another opinion before you discontinue.
- If your patient has thrombophlebitis (signs include sluggish flow rate, edema around the IV site, and a vein that looks like a red line; the vein will be hard, warm, and sore), you *must* discontinue the IV.

To discontinue an IV:

1. Explain to the patient why his or her IV needs to be discontinued. Also, explain that he or she will probably need to have another one inserted upon arrival at the other facility.
2. Gather all equipment: two 2 × 2s or 4 × 4s and tape.
3. Whenever blood or body fluids are being handled, wear protective clothing.
4. Open your packages and prepare two pieces of tape about three inches long.
5. Clamp off the IV.
6. Loosen all the tape on the IV site.
7. Stabilize the extremity and hub.
8. Gently pull out the catheter and apply pressure immediately upon removal.
9. Place a 2 × 2 on the IV site and hold pressure for

☐ COMMUNICATION WITH THE EMERGENCY DEPARTMENT

During IV therapy, it is essential that you communicate effectively with personnel in the emergency department. Repeat all orders verbally to the emergency department so that everyone understands what has been ordered.

10. Apply a 2 × 2, and tape.
11. If infiltration is present, elevate the extremity on a pillow.
12. Apply a warm, moist pack when possible.
13. Document and record:
 - Amount of fluid left in the bag.
 - Amount of fluid the patient received.
 - Time of discontinuation of the IV.
 - Any other problems.
14. Dispose of used needles in a Sharps container (Figure A2-19).

FIGURE A2-19 Dispose of used needles in a Sharps container.



ADVANCED PREHOSPITAL CARE OBJECTIVES: INTRODUCTION TO IV THERAPY/IV CANNULATION TECHNIQUESReferences: Paramedic Training Manual, Volume I: EMT-P Skills Manual

Skills: Administration of Medication by IV Bolus Injection using a Preload Drug; Addition to IV Solution and Infusion via Piggyback Line; Saline Locks; Venipuncture Using a Catheter-Over Needle

Upon completion of this unit of instruction, the participant will be able to:

LEARNING OBJECTIVES	LESSON CONTENT	NOTES
1. Describe the purposes for starting an intravenous line in the field.	1. Purpose: <ul style="list-style-type: none"> o volume replacement o administration of drugs o precautionary measure 	
2. Identify the IV solution approved for use by EMT-Ps in Los Angeles County.	2. 0.9% NaCl (normal saline)	EMT-P Regulations include intravenous glucose solutions or isotonic balanced salt solutions including Ringer's lactate solution
3. Identify the IV solution appropriate for volume replacement.	3. 0.9% NaCl (normal saline)	
4. Identify the checks which should be made prior to using an IV solution.	4. Checks: <ul style="list-style-type: none"> o integrity of container and seal o clarity of solution o expiration date o correct solution o correct amount of solution 	

LEARNING OBJECTIVES	LESSON CONTENT	NOTES
5. Identify possible complications of IV therapy.	<p>5. Complications:</p> <ul style="list-style-type: none"> o infiltration o embolus o infection o circulatory overload o venous thrombosis 	
6. Identify four types of IV tubings and give examples of their use.	<p>6. Tubings:</p> <p><u>Minidrip</u> - 60 mcgts/ml (drops/min = ml/hr). Used for medication administration or as precautionary line when volume replacement is not indicated.</p> <p><u>Maxidrip</u> - variable gts/ml. Used for volume replacement.</p> <p><u>Blood tubing</u> - variable gts/min. Used for volume replacement or if potential for blood transfusion exists.</p> <p><u>Shock tubing</u> - high flow. Used for large scale fluid administration. Can sustain high pressures from pressure infusing devices.</p>	
7. Define "large bore" IV cannula.	7. Large bore - size 14-16 gauge	
8. Define:	8. Definitions:	
A. IV push/bolus (IVP)	A. <u>IV push/bolus (IVP)</u> - concentrated dose of medication injected directly into a vein via the IV tubing or saline lock	
B. IV piggyback (IVPB)	B. <u>IV piggyback (IVPB)</u> - diluted dose of a drug mixed with a specified amount of IV solution and infused into the main IV line using an additional IV set up	
C. Pre-existing vascular access device (PVAD)	C. <u>PVAD</u> - indwelling catheter device placed into one of the central veins to provide vascular access for patients requiring long term IV therapy or hemodialysis	Paramedics may only access PVADs for IV infusion or medication administration if unable to establish a peripheral line on patients in full arrest or in extremis due to circulatory shock
D. Saline lock	D. <u>Saline lock</u> - an intermittent IV device which consists of an IV cap/plug inserted into the IV catheter and accessed for direct IVP or IVPB infusions	

LEARNING OBJECTIVES	LESSON CONTENT	NOTES
9. Identify the indications for using a saline lock.	9. Indications: o patient has stable vital signs o volume replacement not needed	EMT-P Regulations include heparin in locks
10. Identify the rationale for using an arm board.	10. An arm board assists in immobilizing a joint and securing the IV site to prevent infiltration or dislodgement of the IV catheter	
11. Identify the purpose for labeling all IV piggyback medication and the information which must be included on the label.	11. Labeling IVPB medications is to identify contents and administration in order that this information is available to other paramedics or hospital personnel Label should include: o name of medication o dose o date/time o initials (of initiator)	
12. Demonstrate venipuncture and intravenous medication techniques.	12. Skills Tests: o Venipuncture Using Catheter Over Needle Device o Saline Lock o Addition of Medication by IV Volume Injection Using a Preload Drug o Addition of Medication to IV Solution and Infusion via Piggyback Line	

EXHIBIT C

Introduction To IV Therapy and IV Cannulation Techniques
Lesson Plan
Ventura County Medical Center
Ojai Ambulance, Inc.

<u>Learning Objectives</u>	<u>Lesson Content</u>	<u>Notes</u>
1. Describe the purpose for starting an intravenous line in the field.	1. Purpose: <input type="checkbox"/> Volume replacement <input type="checkbox"/> Administration of medications <input type="checkbox"/> Potential for volume replacement and/or medication administration	
2. Identify the IV solutions approved for use by field personnel in Ventura County.	2. 0.9% NaCL (normal saline) 5% Dextrose in water (D5W) (not to be used by EMTs)	
3. Identify the IV solution appropriate for volume replacement and as a medication delivery vehicle.	3. 0.9% NaCL (normal saline)	

Learning ObjectivesLesson ContentNotes

4. Identify three types of IV tubings and give examples of their use.

4. Tubings:

Minidrip:

60 mcgts/ml (drops = ml/hr.)

Used for medication administration or as a precautionary line when volume replacement is not indicated.

Maxidrip:

Variable gts/ml. Used for volume replacement.

Blood Tubing:

Variable gts/ml. Used for volume replacement when the potential for blood transfusion exists.

5. Define "large bore" IV cannula.
6. Identify the checks which should be made prior to using an IV solution.

5. Large bore: size 14 to 16 gauge

6. Checks:

- ☐ Integrity of container and seal
- ☐ Clarity of solution
- ☐ Correct solution
- ☐ Correct amount of solution
- ☐ Expiration date

<u>Learning Objectives</u>	<u>Lesson Content</u>	<u>Notes</u>
7. Demonstrate venipuncture and techniques.	7. Skills Demonstration	
8. Identify the indications for using a saline lock.	8. Indications: <input type="checkbox"/> Patient has stable vital signs <input type="checkbox"/> Volume replacement not needed	
9. Identify the rational for using an arm board.	9. An arm board assists in immobilizing a joint and securing the IV site to prevent infiltration or dislodgment of the IV catheter. <input type="checkbox"/> See Attached	
10. Identify possible complications of IV therapy and treatment for each.	10. Complications: <input type="checkbox"/> Subcutaneous infiltration <input type="checkbox"/> Catheter or air embolus <input type="checkbox"/> Infection <input type="checkbox"/> Circulatory overload <input type="checkbox"/> Venous thrombosis	

Learning Objectives

Lesson Content

Notes

11. Identify the need for "sharps" awareness and describe the management of sharps containment.

11. Safety

- ☐ Awareness
- ☐ Disposal
- ☐ Procedure for needle stick

Sections 12 & 13 taught as information only. Only paramedics may access PVADs or infuse any medications.

12. Define	12. Definitions:
A. IV push/bolus	A. Concentrated dose of medication injected directly into a vein via the IV tubing or saline lock.
B. IV piggyback (IVPB)	B. Diluted dose of a drug mixed with a specified amount of IV solution and infused into the main IV line using an additional IV set up.
C. Pre-existing vascular access device (PVAD)	C. Indwelling catheter device placed into one of the central veins to provide vascular access for patients requiring long term IV therapy or hemodialysis.
13. Identify the purpose for labeling all piggyback medication and the information which must be included on the label.	<p>13. Labeling IVPB medications is to identify contents and administration in order that this information is available to other paramedics or hospital personnel. Label should include:</p> <p>✓ name of medication</p> <p>✓ dose</p> <p>✓ date/time</p> <p>✓ initials (of initiator)</p>

Learning Objectives

14. Demonstrate understanding of IV therapy and cannulation technique.

Lesson Content

14. Written test with a score of 80% or greater.
Skills Test: Pass/Fail

Notes

EXHIBIT D
EMT Intravenous Cannulation Evaluation

Date:			
BH Log #			
PFR#			
Reason for IV:	() Volume Replacement () Med Administration () Precautionary Line		
Successful	() Yes () No-Must Comment		
Location:	Catheter Size: _____		
() IV () Saline Lock			

Incident Information

Proper equipment assembly	() Yes () No-Must Comment		
Proper technique	() Yes () No-Must Comment		
Paramedic comments:			
Paramedic signature:	_____		
EMT signature:	_____		
Printed name:	_____		

Paramedic Assessment

Receiving Hospital:	_____		
IV Patent upon arrival:	() Yes () No-Must Comment		
IV Placement appropriate:	() Yes () No-Must Comment		
Comments:			
RN or MD assessing care signature:	_____		
Printed name:	_____		

Receiving Hospital

Base Hospital:	VCMC		
Comments:			
PCC Signature:	_____		

QA